NIST Combinatorial Methods Center

Collaborating to Accelerate Materials Discovery

Speeding the pace of materials innovation is the goal of the Combinatorial Methods Center at the National Institute of Standards and Technology, the nation's leader in measurement science. Techniques for high-throughput screening and analysis already have revolutionized the process of discovery in the pharmaceutical industry. Now, NIST and its partners are refining and extending these "combinatorial methods" to make the search for advanced materials more efficient, more productive, and more cost effective.

The NIST Combinatorial Methods Center, or NCMC, presents a prime opportunity for companies, universities, and government laboratories to transform the way advanced materials are identified and developed. NCMC collaborators are making a break from the protracted practice of testing materials one at a time. They are developing integrated—and, often, automated—capabilities for exploring a wide range of characteristics in parallel and on a miniaturized scale.

These capabilities will enable researchers to quickly evaluate materials properties (such as thickness and composition) and processing conditions (such as temperature). At a rapid clip, they are able to screen for materials optimized for applications in biomedicine, microelectronics, nanotechnology, and more. And with the quickly accumulating data, they can build predictive models that will further propel the quest for superior materials.

What NIST Offers

An international leader in measurement matters and home to two Nobel Prize winners, NIST is a key component of the nation's science and technology infrastructure. The Institute's seven major laboratories supply research and services that underpin performance in the lab, factory, and beyond. Often, tests, measurements, and standards developed by NIST—usually in partnership with other organizations—are necessary to unlock the full potential of new discoveries and budding technologies.

Combinatorial methods are a textbook example. These emerging tools have the potential to speed the rate of innovation in many fields. In the diverse realm of materials, combinatorial methods hold promise for all classes and all specialty areas, from metals and intermetallics to polymers and polymer composites and from ceramics and biomaterials to fire retardants and adhesives.

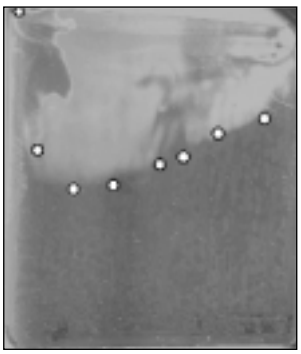
The NCMC aims to develop measurement techniques and other vital tools needed to progress from tantalizing promise to tangible benefits in the pursuit of new materials.

NIST already is a hub of research aimed at broadening combinatorial-method applications. More than 25 projects address hurdles that must be overcome so that high-throughput approaches can accelerate the pace of knowledge discovery. Topics include informatics (methods for generating, storing, retrieving, and sharing data), imaging technologies, and specific materials classes, formulations, and properties. Some examples:

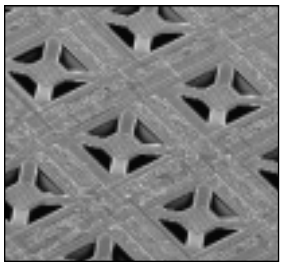
- Polymer blends, coatings, and films
- Thermal property screening
- Methods for building combinatorial libraries
- Fire retardants, adhesives, dielectric oxides
- Service life prediction
- Semicrystalline polymers
- Fluid properties microanalysis
- Microhotplate array platforms
- Laser scanning microscopy
- Infrared chemical imaging
- Polarized light scattering
- Modeling and characterization
- Biocompatibility assays
- Quantitative spectral imaging
- Chemical microscopy
- Data mining
- High throughput measurements

Emphasis on Collaboration

The NCMC is a vehicle for collaboration, the means to leverage personnel, facilities, and capabilities. Sharing of expertise, resources, and information reduces obstacles to participating in the fast-moving, instrument-intensive area of combinatorial materials science. Collaboration also encourages cross-fertilization of ideas and research strategies, which can lead to new insights and spur progress on many fronts—across organizations, disciplines, and interests.



Using a single sample, NCMC techniques yield a complete polymer-blend phase diagram that shows the influence of systematic changes in temperature and blend composition.



NIST-developed arrays of miniature hotplates enable parallel studies of tens to hundreds of samples. Each hotplate can be programmed and controlled independently.

Three levels of NCMC participation are offered. Prospective members can collaborate as participating members, in non-proprietary focused projects, and through cooperative research and development agreements that can address the treatment of proprietary information and the disposition of intellectual property stemming from joint research.

Semiannual NCMC meetings begin with open technical sessions devoted to new developments in combinatorial materials science. These are followed by members-only meetings that include short courses, workshops, and laboratory demonstrations. In addition, specialized meetings tailored to specific research objectives are organized for participants in NCMC projects.

NCMC members have access to data libraries and pre-prints of research papers. An on-line bulletin board supports discussions on topics important to the application and advancement of combinatorial methods.

For more information:

To learn more about the NIST Combinatorial Methods Center:

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or visit the NCMC web site at:
http://www.nist.gov/combi

The public web site offers overviews of the specific combinatorial methods research projects underway at NIST.